

CLAIMS

We claim:

1 1. A method in a wearable computer for providing information about a
2 current state of a user of the wearable computer, the current state modeled with multiple
3 state attributes, values of some of the state attributes used as inputs for generating values
4 of other state attributes, the wearable computer executing a plurality of state server
5 modules (SSMs) to supply values for the state attributes, a plurality of state client
6 modules (SCMs) to receive and process values for the state attributes, and an
7 intermediary module (IM) to facilitate exchange of state attribute values, comprising:
8 under control of each SSM, generating values for at least one of the state
9 attributes and sending the generated values to the IM;
10 under control of each SCM, requesting the IM to supply values for at least
11 one specified state attribute and receiving requested values from the IM;
12 under control of a first module that is one of the SSMs and one of the
13 SCMs, if a value of a first specified state attribute is received from the IM, generating a
14 value for a first state attribute based at least in part on the received value and sending the
15 generated value to the IM;
16 under control of a second module that is one of the SSMs and one of the
17 SCMs, if a value of a second specified state attribute is received from the IM, generating
18 a value for a second state attribute based at least in part on the received value and sending
19 the generated value to the IM; and
20 under control of the IM,
21 receiving the values for state attributes sent from the SSMs, receiving
22 the requests for values of specified state attributes from the SCMs, and sending values
23 received from the SSMs for the specified state attributes to the SCMs in response to the
24 received requests;

25 determining if a value to be generated by the first module for the first
26 state attribute and if a value to be generated by the second module for the second state
27 attribute are each based at least in part on a received input value of the other of the first
28 and second state attribute; and

29 when it is determined that values to be generated for the first and
30 second state attributes are each based at least in part on received input values of the other
31 first and second state attribute, notifying at least one of the first and second modules to
32 not generate values for the first or second state attribute,
33 so that the intermediary module supplies values for state attributes only when appropriate.

1 2. The method of claim 1 including:

2 under the control of the first module, before the sending of a generated
3 value for the first state attribute to the IM, sending to the IM a registration message
4 indicating a current availability of the first module to supply values for the first state
5 attribute based at least in part on values of the first specified state attribute; and

6 under the control of the second module, before the sending of a generated
7 value for the second state attribute to the IM, sending to the IM a registration message
8 indicating a current availability of the second module to supply values for the second
9 state attribute based at least in part on values of the second specified state attribute,

10 and wherein the determining by the IM of whether the values to be
11 generated for each of the first and second state attributes are based at least in part on
12 received input values of the other first and second state attribute is based on analysis of
13 the sent registration messages.

1 3. The method of claim 2 including:

2 under control of each SSM, before the sending of generated values for an
3 indicated state attribute to the IM, sending to the IM a registration message indicating a
4 current availability of the SSM to supply values for the indicated state attribute; and

under control of each SCM, before the requesting by the SCM that the IM supply the values of a specified state attribute, sending to the IM a registration message indicating a current desire to receive values for the specified state attribute.

4. The method of claim 1 wherein the determining of whether the values to be generated for each of the first and second state attributes are based at least in part on received input values of the other of the first and second state attributes is dynamically performed as part of the generating of a value for the first or second state attributes by, during the generating of the value for the attribute, recursively tracking requests sent to the IM to supply values for state attributes to be used as input values for the generating of other state attribute values and detecting a circular reference for the value of the attribute being generated when a value of the attribute is requested in one of the tracked requests as an input value for the generating of one of the other state attribute values.

5. The method of claim 1 including notifying the first module to not generate values for the first state attribute by not supplying a requested value for the first specified state attribute to the first module.

6. The method of claim 1 wherein multiple SSMs are able to supply values for the second state attribute, and including:

when it is determined that the values to be generated for the first and second state attributes by the first and second modules are each based at least in part on received input values of the other of the first and second state attributes, determining if one of the multiple SSMs other than the second module can generate a value for the second state attribute in such a manner that the values to be generated for the first and second state attributes by the first module and the one SSM are not each based at least in part on received input values of the other of the first and second state attributes; and

when it is determined that the values to be generated for the first and second state attributes by the first module and the one SSM are not each based at least in

6 determining a manner of generating the value of the another state
7 attribute without needing the value of the first state attribute; and
8 facilitating the generating of the value of the first other state attribute
9 in the determined manner.

1 14. The method of claim 11 wherein the value of the indicated first state
2 attribute that is requested in the one monitored request is needed for generating a value of
3 another state attribute, and including:

4 after the determining that the state attribute indicated in the one monitored
5 request is the first state attribute,

6 determining an alternate state attribute whose value can replace a need
7 for the value of the another state attribute; and

8 facilitating a generating of the value of the alternate state attribute.

1 15. The method of claim 11 wherein the received request from the first
2 client additionally indicates that the client-source is to be the source of the requested first
3 state attribute value, and wherein the determining of the client-source is based on the
4 receiving of the indication.

1 16. The method of claim 11 including, before the requesting of the
2 client-source to supply the requested value of the first state attribute, determining whether
3 a previously obtained value satisfies a criteria for the requested value, and wherein the
4 requesting is performed only when it is determined that the previously obtained value
5 does not satisfy the criteria.

1 17. The method of claim 11 including receiving the value of the first
2 state attribute from the client-source and supplying the received value to the first client.

1 18. The method of claim 11 including determining whether a requested
2 value of an indicated state attribute is needed for the generating of a value of another state

attribute that is indicated in one of the monitored requests based on an identifier related to the generating of the first state attribute value that is included in the request.

19. The method of claim 11 wherein the multiple state attributes represent information about a user of the computer.

20. The method of claim 19 wherein the represented information reflects a modeled mental state of the user.

21. The method of claim 11 wherein the multiple state attributes represent information about the computer.

22. The method of claim 11 wherein the multiple state attributes represent information about a physical environment.

23. The method of claim 11 wherein the multiple state attributes represent information about a cyber-environment of a user of the computer.

24. The method of claim 11 wherein receiving of the requested value by the first client prompts the first client to present information to a user of the first client.

25. A computer-readable medium containing contents that cause a computing device to provide information about a current state that is modeled with multiple state attributes, at least some of the state attributes having values that are requested by client-sources to be used for generating values of other state attributes, by:

receiving a request from a first client for a value of a first of the state attributes;

determining a client-source able to generate and supply the requested value of the first state attribute by using a value of at least one other state attribute;

requesting the client-source to supply the requested value of the first state attribute; and

during generating of the requested value of the first state attribute by the client-source,

monitoring requests from the client-source for values of one or more indicated state attributes needed for the generating of the requested value of the first state attribute;

monitoring other requests for values of indicated state attributes needed for generating values of state attributes that are indicated in previously monitored requests; and

when it is determined that a state attribute indicated in one of the monitored requests is the first state attribute, indicating a presence of a circular reference during the generating of the requested value of the first state attribute.

26. The computer-readable medium of claim 25 wherein the computer-readable medium is a memory of the computing device.

27. A computing device for providing information about a current state that is represented with multiple attributes, comprising:

an attribute value request component that is capable of receiving a request for a value of a first of the state attributes from a first client; and

an attribute value supplier component that is capable of determining a client-source able to generate and supply the requested value of the first state attribute by using a value of at least one other state attribute, of requesting the client-source to supply the requested value of the first state attribute, and of, during generating of the requested value of the first state attribute by the client-source, monitoring requests from the client-source for values of one or more indicated state attributes needed for the generating of the requested value of the first state attribute, monitoring other requests for values of indicated state attributes needed for generating values of other state attributes that are indicated in one of the monitored requests, and indicating presence of a circular reference

14 when it is determined that a state attribute indicated in one of the monitored requests is
15 the first state attribute.

1 28. The computing device of claim 27 wherein the attribute value
2 request component and the attribute value supplier component are part of an intermediary
3 module executing in memory.

1 29. The computing device of claim 27 further comprising multiple
2 sources and multiple clients executing in the memory.

1 30. A method in a computer for providing information about a current
2 state that is modeled with multiple state attributes, at least some of the state attributes
3 having values that when supplied to client-sources cause the client-sources to generate
4 values of other state attributes, the method comprising:

5 receiving a value of a first of the state attributes from a first source;

6 determining a client-source that desires to receive values of the first state
7 attribute, the receipt of a value of the first state attribute by the client-source to cause the
8 client-source to generate and supply a value of another of the state attributes;

9 supplying the received value of the first state attribute to the client-source;

10 receiving a value of the another state attribute from the client-source such
11 that the generation of the received value was caused by receipt by the client-source of the
12 supplied value of the first state attribute;

13 supplying the received value of the another state attributes to client-sources
14 that each desire to receive the received value, the receipt of the supplied values by the
15 client-sources causing at least some of the client-sources to generate and supply other
16 values of state attributes; and

17 when one of the other values is received, if the one value is of the first state
18 attribute, indicating a presence of a circular reference based on the supplying of the value
19 of the first state attribute.

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1 31. The method of claim 30 wherein the indicating of the presence of the
2 circular reference includes halting generating of values that would be caused by receipt of
3 the one first state attribute value by not supplying the one first state attribute value to the
4 determined client-source.

1 32. The method of claim 31 including supplying the supplied value to
2 each of a group of client-sources other than the determined client-source that desire to
3 receive values of the first state attribute.

1 33. The method of claim 30 wherein the received value of the first state
2 attribute from the first source additionally indicates that the determined client-source is to
3 be a recipient of the received first state attribute value, and wherein the determining of
4 the client-source is based on the receiving of the indication.

1 34. The method of claim 30 including, before the supplying of the
2 received value of the first state attribute to the client-source, determining whether a value
3 previously supplied to the client-source satisfies a criteria, and wherein the supplying of
4 the received value is performed only when it is determined that the previously supplied
5 value does not satisfy the criteria.

1 35. The method of claim 30 including receiving one of the other values
2 of a state attribute other than the first state attribute, and supplying the received other
3 value to clients that desire to receive values of the state attribute.

1 36. The method of claim 30 including determining whether a client or
2 client-source desires to receive a received value of a state attribute based on an indication
3 of the client or the client-source that is included with the received value.

1 37. The method of claim 30 including determining whether a client or
2 client-source desires to receive a received value of a state attribute based on previously
3 received indications from the client or client-source.

1 38. The method of claim 30 wherein the multiple state attributes
2 represent information about a user of the computer.

1 39. The method of claim 30 wherein the receiving of the supplied value
2 of the first state attribute by the client-source prompts the client-source to present
3 information to a user of the client-source.

1 40. A computer-readable medium containing instructions that when
2 executed cause a computing device to provide information about a current state that is
3 modeled with multiple state attributes, at least some of the state attributes having values
4 that when supplied to client-sources cause the client-sources to generate values of other
5 state attributes, by:

6 receiving a value of a first of the state attributes from a first source;

7 determining a client-source that desires to receive values of the first state
8 attribute, the receipt of a value of the first state attribute by the client-source to cause the
9 client-source to generate and supply a value of another of the state attributes;

10 supplying the received value of the first state attribute to the client-source;

11 receiving a value of the another state attribute from the client-source such
12 that the generation of the received value was caused by receipt by the client-source of the
13 supplied value of the first state attribute;

14 supplying the received value of the another state attributes to client-sources
15 that each desire to receive the received value, the receipt of the supplied values by the
16 client-sources causing at least some of the client-sources to generate and supply other
17 values of state attributes; and

when one of the other values is received, if the one value is of the first state attribute, indicating a presence of a circular reference based on the supplying of the value of the first state attribute.

41. A computing device for providing information about a current state that is represented with multiple attributes, comprising:

an attribute value receiver component that is capable of receiving a value of a first of the state attributes from a first source; and

an attribute value supplier component that is capable of determining a client-source that desires to receive values of the first state attribute, the receipt of a value of the first state attribute by the client-source to cause the client-source to generate and supply at least one value of another of the state attribute, of supplying the received value of the first state attribute to the client-source, of receiving one or more values of other state attributes from the client-source such that the generation of each of the received values was caused by receipt of the supplied value of the first state attribute by the client-source, of supplying each of the received values of one of the other state attributes to client-sources that desire to receive the received values, the receipt of the supplied values causing at least some of the client-sources to generate and supply other values of state attributes, and of indicating presence of a circular reference when one of the other values is received if the received one value is of the first state attribute.

42. A method in a portable computer for providing information about a context that is modeled with multiple context attributes, at least some of the context attributes having values used by modules for generating values of other context attributes, comprising:

determining that a first module is generating a first value of a first of the context attributes of the modeled context; and

determining that a circular reference exists when it is determined that a module is to generate another value of the first context attribute such that the generating

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1 55. The method of claim 42 wherein the context attributes are
2 dynamically defined by client modules who indicate an interest in receiving values for the
3 defined attributes.

1 56. A computer-readable medium whose contents cause a computing
2 device to provide information about a context that is modeled with multiple context
3 attributes, at least some of the context attributes having values used by modules for
4 generating values of other context attributes, by:

5 determining that a first module is generating a first value of a first of the
6 context attributes of the modeled context; and

7 determining that a circular reference exists when it is determined that a
8 module is to generate another value of the first context attribute such that the generating
9 of the another value is caused by the generating of the first value of the first context
10 attribute.

1 57. A computer-readable generated data signal transmitted via a
2 transmission medium, the generated data signal having encoded contents that cause a
3 computer system to provide information about a context that is modeled with multiple
4 context attributes, at least some of the context attributes having values used by modules
5 for generating values of other context attributes, by:

6 determining that a first module is generating a first value of a first of the
7 context attributes of the modeled context; and

8 determining that a circular reference exists when it is determined that a
9 module is to generate another value of the first context attribute such that the generating
10 of the another value is caused by the generating of the first value of the first context
11 attribute.

1 58. A portable computing device for providing information about a
2 context that is represented with multiple attributes, comprising:

3 an first component that is capable of determining that a first module is
4 generating a first value of a first of the attributes of the context; and

5 an second component that is capable of determining that a circular
6 reference exists when it is determined that a module is to generate another value of the
7 first attribute such that the generating of the another value is caused by the generating of
8 the first value of the first attribute.

1 59. A portable computing device for providing information about a
2 context that is represented with multiple attributes, comprising:

3 means for determining that a first module is generating a first value of a
4 first of the context attributes of the modeled context; and

5 means for determining that a circular reference exists when it is determined
6 that a module is to generate another value of the first context attribute such that the
7 generating of the another value is caused by the generating of the first value of the first
8 context attribute.